

SNS 104050200-SW0001 - R00

Statement of Work (SOW)**Coupled Cavity Linac (CCL) Beam Position Monitor (BPM) Fabrication
For the Spallation Neutron Source (SNS)**

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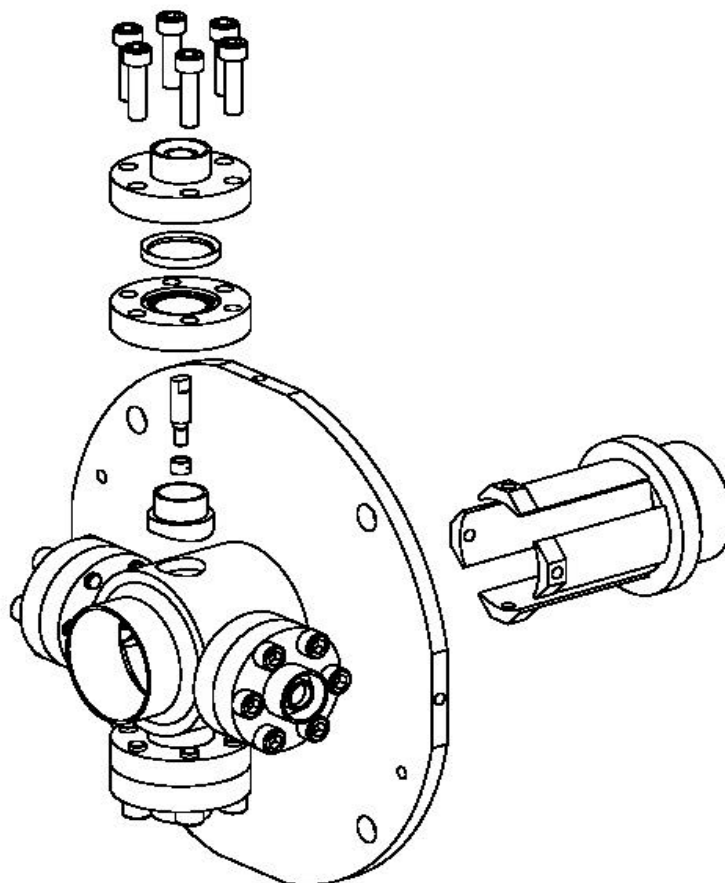
**CCL BPM Assembly**

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1 General Description

The SNS Division at Los Alamos National Laboratory (LANL) is engaged in the design, fabrication, and operation of various particle beam accelerator components for the SNS project. One of these components is the Coupled Cavity Linear Accelerator (CCL). The CCL for the SNS project will accelerate a proton beam from 87 million electron volts (MeV) to 200 MeV. The CCL contains a series of segments that the proton beam passes through. Between these segments are regions of beam line where beam focusing occurs and beam diagnostics are placed. These regions are termed inter-segments and this is where the BPMs are located. 16 Beam Position Monitors (BPMs) are required (11 installed and 1 prototype). These BPMs will allow monitoring of the beam's position as it travels the length of the CCL.

2 Scope

This statement of work is for the fabrication and delivery of 1 prototype BPM assembly and 11 BPM assemblies. LANL drawings and this document define the scope of work.

3 Deliverables

The deliverables shall include the following:

3.1 Manufacturing Process Plan

A manufacturing process plan (MPP) shall be submitted as part of the quotation. See section 6.0 for details of the MPP.

3.2 Fabricate and deliver prototype CCL BPM assembly

The seller shall fabricate and deliver a prototype BPM assembly per LANL drawings, this document, and the purchase order. The quantity totals and part numbers are tabulated below:

Quantity	Part No.	Description
1	155Y520100	BPM 15.0 mm Radius Assembly

3.3 Fabricate and deliver CCL BPM assemblies

The seller shall fabricate and deliver BPM assemblies per LANL drawings, this document, and the purchase order. The quantity totals and part numbers are tabulated below:

Quantity	Part No.	Description
11	155Y520100	BPM 15.0 mm Radius Assembly

3.4 Shipping Containers

The seller shall provide shipping containers for each beam position monitor assembly. See section 12.0.

3.5 Inspection

The seller shall perform a 100% dimensional inspection and prepare a written report of all dimensions. Report documents shall be produced in electronic formats such as Microsoft Word, Excel and or Adobe Acrobat PDF. All individual inspection data sheets shall clearly specify and

correlate to the marked serial numbers on each beam position monitor assembly. Hard copies of written inspection reports shall be included with each shipment.

3.6 Vacuum Integrity Testing

The seller shall perform vacuum leak integrity tests as required to assure the vacuum integrity of the final assemblies. See section 9.0

3.7 Final Vacuum Cleaning and Handling Procedure

The seller shall perform a final vacuum cleaning procedure prior to packaging for each completed BPM assembly. See section 10.0

3.8 Test Reports

The seller shall provide written reports on each completed test for each CCL BPM assembly with each shipment. Report documents shall be produced in electronic formats such as Microsoft Word, Excel and or Adobe Acrobat PDF. All individual test data sheets shall clearly specify and correlate to the marked serial numbers on each beam position monitor assembly.

3.9 Digital Images

The seller shall document using digital images during all manufacturing steps and qualification tests, and the images shall be included in the final documentation and test reports. Digital images shall be available by electronic means (email or floppy disks) upon request by LANL for use in internal (LANL) status reports.

4 Purchaser/government furnished material (GFM)

LANL will supply KAMAN SMA-F UHV Connector Assembly Feed throughs in quantities sufficient to manufacture all assemblies. Please see parts list item 4 on drawing 155Y520100.

5 Schedule

All delivery schedules shall be provided in the seller's quotation.

6 Manufacturing Plan

A brief Manufacturing Process Plan (MPP) shall be submitted with the quotation. The Manufacturing Process Plan shall outline the proposed method of BPM fabrication, assembly, and testing. The MPP shall include as a minimum the following information:

6.1 Material certifications

Material certification processes.

6.2 Joining process information

Procedures, alloys, and filler materials pertaining to the joining process.

6.3 Weld and braze joint design

Explanation of weld/braze joint design (including any fixturing) to be utilized in manufacturing.

6.4 Cleaning procedures

Procedures for maintaining the cleanliness of individual piece parts and final assemblies.

6.5 Vacuum leak testing

Vacuum leak testing capabilities including hold points for determining the quality of vacuum prior to the final leak test as required on the drawing notes.

6.6 Inspection methods

A description of the inspection methods to be utilized for dimensional compliance and verification of drawing tolerances.

6.7 Manufacturing sequence

A sequence of manufacturing operations to insure compliance with LANL drawings.

6.8 Marking, handling, bagging, and storing

The procedures and materials used for marking, handling, bagging and storing the final BPM assemblies.

6.9 Electrode deflection procedure

Explanation of how the seller proposes to manufacture the assemblies and a description of the required tooling to comply with note 902 on drawing 155Y520100 and note 904 on drawing 155Y520101.

7 Quality Assurance Program Provisions

7.1 Quality Assurance Program

LANL requires the seller to provide a copy of his and any of his subcontractor's latest quality assurance manuals that will be employed during the fabrication and inspection of the components in this SOW. Documents shall be provided in electronic formats such as Microsoft Word, Excel and or Adobe Acrobat PDF. These documents shall be included in the manufacturing plan and submitted at the same time.

7.2 Inspection

LANL requires an inspection report of all dimensions. Hard copy inspection reports for each item shall accompany the final shipment. The seller shall be responsible for performing all required inspections, analyses, and tests designated herein. All testing and inspection shall be performed at the seller's facilities, or at the facilities of a mutually acceptable Designated Test Agency.

8 Fabrication Requirements

The fabrication of the BPMs shall be in strict accordance with LANL supplied drawings, the purchase request, and the following.

8.1 Material Specifications

Stainless parts to be constructed from ASTM A269 304L seamless and welded tubing and ASTM A240 plate or ASTM A276 bar or approved equivalent. See LANL supplied drawings for specifics.

8.2 Cutting Fluids

The seller shall not use Sulfur based machining fluids or oils on any parts.



8.3 Brazing

Furnace braze shall be in accordance with ANSI/AWS C3.6-1990, Class C. Braze using alloy similar or equal to Wesgo Copper (99.99% Cu) liquidus 1083 C. All dimensions on LANL supplied drawings apply after brazing. Braze symbols on drawings shall be interpreted in accordance with AWS A2.4. Any conflicts or questions related to application or interpretation of weld symbols should be directed to LANL for disposition and clarification. Clean all parts prior to brazing with the process specified in the manufacturing plan. The cleaning process shall be capable of removing all oxides from the braze joints prior to brazing. See section 6.

8.4 Welding

Weld in accordance with ANSI/AWS D1.1 & D10.4.-1996. Electron Beam (EB) weld in accordance with MIL-STD-1595A. Weld procedures and fixtures shall be selected to control distortion within dimensional limits bounded by University drawings. All dimensions on University supplied drawings apply after welding. Weld symbols on drawings shall be interpreted in accordance with AWS A2.4. Any conflicts or questions related to application or interpretation of weld symbols should be directed to the University for disposition and clarification.

8.5 Temperature

Unless otherwise specified on the drawing, all dimensions and tolerances shall be applicable at a temperature of $74^{\circ}\text{F} \pm 4^{\circ}\text{F}$.

8.6 Dimensional Stability

For each part and/or assembly the seller shall determine whether stress relief is required to maintain dimensional stability. Appropriate stress relief procedures shall be performed to insure that tolerances are maintained. If the seller performs stress relief, it shall be accomplished prior to final machining. Stress relief procedures and methods, if any, shall be submitted to LANL in the Manufacturing Plan for review.

8.7 Marking of the BPM Body

The seller shall mark each BPM body with 1/8" characters according to drawing 155Y520104 note 901. In addition the seller shall provide a serial number (1 through 15) near the "R" shown on 155Y520104 for each production BPM assembly.

9 Vacuum Integrity Check

All welded and brazed joints, subassemblies, and completed BPM assemblies (155Y520100) shall be leak checked using the following: Final assembly shall be leak tight. All leak testing shall be done using a Mass Spectrometer Leak Detector (MSLD) calibrated to a minimum sensitivity to Helium of 2×10^{-10} std cc/sec and the part being tested will be pumped down to a pressure of at least 5×10^{-4} Torr or lower. In addition, all leak testing shall use the Tracer Probe Type using a Helium gas probe to introduce the Helium tracer gas to the outside surface of the item being tested. At least one of the tests, the part shall be bagged and Helium shall be introduced inside the bag so as to bathe the component in Helium. A component shall be deemed to pass testing if it exhibits **NO DETECTABLE LEAKS** after it has soaked in Helium for 1 minute. A certificate of compliance traceable to national standards for the equipment being used on this job must be maintained on file at the testing firm's place of business and/or at the location where the testing is being performed. These certificate(s) must be made available to LANL personnel or their representatives for inspection. The MSLD shall be calibrated before and



after each series of tests. Testing shall be done in accordance to ASTM E - 1603-99. Any exceptions to these instructions must be obtained in writing from LANL.

10 Final Vacuum Cleaning Procedures

10.1 Final cleaning

After all qualification tests are performed. BPM assemblies prior to packaging, must be cleaned according to the following procedure: (Note, to do this vinyl class 100 powder free gloves shall be worn.)

- First acetone wipe - use a new clean white 100% cotton cloth.
- First isopropyl alcohol (IPA) wipe - use a new clean white 100% cotton cloth.
- Second acetone wipe using grade GC RESOLVE GRADE Acetone and new clean white 100% cotton cloth.
- Second isopropyl alcohol (IPA) wipe - use a new clean white 100% cotton cloth.
- (Note, if vinyl class 100 powder free gloves are worn, change to clean white cotton gloves before handling cleaned assembly.)

10.2 Deviation from cleaning procedure

Any deviation in this set of cleaning steps must have prior written approval from the buyer. The deviation request must be accompanied with sufficient documented proof that the alternative cleaning process equals or is better than the buyers proposed procedure without the buyer doing any research.

10.3 Clean Handling Procedures

Under no circumstances can hands, clothing or any material that is not sanitized come into contact with the part being vacuum cleaned or after cleaning. If the part is to be assembled into another assembly, the part must be kept clean at all times using clean white cotton gloves. These gloves are considered dirty if the slightest discoloration is visible on the gloves. The gloves will be changed to a new, clean pair, as a minimum, at least once an hour or sooner if dirty.

10.4 Clean Packaging Procedures

Immediately after cleaning in Section 12, the part must be preserved in its' clean state, using clean white cotton gloves for handling, until it is shipped to LANL. To do this, the part must first be wrapped in clean lint and oil free paper¹ and then wrapped in pure aluminum² foil that completely encloses and protects the part. Following the wrapping, the part must be set aside in a clean, dust free and oil free environment until the part is shipped to LANL.

10.5 Review of cleaning and handling steps in the manufacturing process

LANL shall review and approve, in writing, the manufacturing process steps that pertain to cleaning, handling and shipping.

¹) BERKSHIRE CO., Great Barrington, MA, 413-528-2602

² ALL FOILS INC., Independence, OH, 216-661-0211 (Aluminum foil must be of type designated as dry annealed and must be free of any contamination.)



11 Packaging

Each BPM assembly (155Y520100) shall be wrapped and tape sealed in a nylon film sheathing or bag. The type of bag material used and supplier shall be reviewed by LANL so as to comply with outgassing requirements. The resulting sheathing or bag for each assembly shall be thoroughly purged with dry nitrogen gas and resealed. Each bag shall be tagged with the drawing number, revision letter and beam position monitor assembly's dash number. Part numbers shall be visible without an inspector having to open the bag seal.

12 Shipping and Storage

The seller shall be responsible for purchasing or fabricating shipping containers for all transportations of machined components, BPMs, subassemblies and completed assemblies during all stages of fabrication, machining, brazing, welding and testing. The shipping container(s) shall be designed to provide the contents protection from all damages, scratches, marks and etc. during the packaging and shipping process. Contents shall be stabilized against movement, and prevented from any mechanical or chemical damage during transportation. The use of any type of plastic materials in the containers requires approval of LANL due to the possible outgassing of such materials and their permanent effect on the copper components.

13 Causes for Rejection of Parts

The following shall be causes for rejection of completed Drift Tube assemblies, mounts and all other detail parts (but not limited to):

- Vacuum leaks.
- Out of tolerance conditions, per LANL supplied drawings and this Statement of Work.
- Contact of surface "B" item #2 (155Y520100) is not in accordance with specifications.
- Parts improperly cleaned.
- Damage to LANL supplied feed throughs.

14 Documentation

Drawings shall be provided by LANL as hardcopies and if desired electronically. CAD drawings shall be compatible with (or transferable to) the system in use by the SNS project. At present, the project uses Unigraphics design software for mechanical systems. LANL shall provide copies of specifications if requested by the seller. LANL shall provide to the seller the following drawings for fabrication:

Drawing Number	Title
155Y520100	BPM 15.0 mm Radius Assembly
155Y520101	BPM 15.0 mm Radius Sub-assembly
155Y520104	BPM 15.0 mm Radius Cover
155Y520102	BPM 15.0 mm Radius Probe detail
155Y520105	BPM 15.0 mm Radius Electrode
155Y520106	BPM 15.0 mm Radius Flange Weld Spacer
155Y520107	BPM 15.0 mm Radius Alignment Plugs